

The lower edge 417 of the lower portion 410 extends about and is attached to an upwardly extending nipple 428. A collar 430 formed by the lower portion 424 of the housing 418 extends about the lower edge 417 and clamps the lower edge to the nipple 428. The lower portion 424 and upper portion 420 are attached to each other preferably by sonic welding or other appropriate type.

Referring to FIGS. 13 and 14, the connector 400 is particularly suited to eliminating voids and minimizing priming volume as the flow path is within the lower portion 410 of the valve 402 and fluid cannot flow into the space between the valve and upper housing. In addition, by appropriately dimensioning the valve 402, the chamber 416 defined by the lower portion 410 when no luer tip 18 is inserted into the connector 400, defines a volume which is less than the chamber 416' defined by the lower portion 410 when the luer tip is inserted. Thus siphoning of fluid into the chamber 416 upon removal of the tip 18 is avoided. Instead a slight flow of fluid from the chamber 416' through the lower end of the valve 426 upon removal of the tip 18 may occur.

Referring to FIGS. 15 and 16 a needleless connector particularly suited to preventing siphoning upon removal of a luer tip 18 is generally indicated at 450. Preferably the connector 450 is similar to the connector 400 (FIG. 13) and elements in the connector 450 corresponding to elements in the connector 400 are labeled with the same reference number.

However connector 450 also includes a collapsing member 452, preferably a split collar 454 which is disposed in the void 456 between the lower portion 410 of the valve 402 and the upper portion 420 of the housing 418. The collapsing member 452 includes opposing inward landings 458 disposed on opposite sides of the lower portion 410 and engaging the lower portion to collapse the lower portion thereby lowering the volume of a chamber 460 defined by the lower portion. The landings 458 are resiliently supported by legs 464 angled in an outward direction. The collapsing member 452 may be composed of metal or other material which provides the desired resiliency in the legs 464.

Upon insertion of the luer tip 18, the luer tip 18 forces the landings 458 outward, bending the legs 464 so that the legs become generally aligned with the landings 458 and the lower portion 410 below the tip 18 defines the chamber 460'. Fluid may then be injected into the connector. Upon removal of the tip 18, the resiliency of the lower portion 410 will cause the lower portion to seek to assume the conical shape; however, the legs 464 will force the landings 458 inward to further collapse the lower portion such that the chamber 460 defined by the lower portion has a smaller volume than chamber 460'. Thus siphoning of fluid into the chamber 460 upon removal of the tip 18 is avoided and a slight volume of fluid is expelled from the chamber 460' through the lower end 426 upon the tip removal.

It will be understood that the embodiments of the present invention which have been described are illustrative of some of the applications of the principles of the present invention. Various modifications may be made by those skilled in the art without departing from the true spirit and scope of the invention.

What is claimed is:

1. A connector device for establishing a sealed connection with a male luer assembly configured to conform to ISO standards, said assembly including a male luer tip, said male luer tip encircled by an annular locking flange, said male luer tip and said flange defining a generally cylindrical space between said flange and said tip, said connector device comprising:

a housing forming an upper end opening and a central first passageway sized to receive the male luer tip, said housing having an upper end portion configured to fit within the space defined by the male luer assembly when the male luer tip is inserted downward into said opening, said first central passageway extending from said opening in a downward direction within said housing, said housing including a first upper edge portion having an outside surface of generally constant first diameter, and a second lower portion spaced from said upper edge portion and having an outside surface of a generally constant second diameter, said second diameter being larger than said first diameter, said housing including a third intermediate portion extending from said distal edge portion to said second portion, said third portion having an outside surface with a changing diameter;

a resealable valve resiliently restrained relative to said housing, said valve including a first portion configured to seal said opening prior to insertion of said tip and having an upper surface radially extending across said opening, said upper surface being disposed and shaped to be easily wipeable, a second extension portion integral with said first portion and extending generally vertically downward within said passageway from a lower surface of said first portion, said valve having a third extension portion attached to one of said extension portion and a lower surface of said radial portion and extending downward, a lower end portion of said extension portion attached to said housing to form a sealed second passageway within said extension portion, said extension portion and said housing defining a generally annular space between said extension portion and said housing; and

an opening formed in said valve such that when the luer tip is inserted downward into said opening in said housing and through said septum said first portion and said second portion elastically extend about the luer tip and form a seal about said luer tip and allow fluid to be injected from said tip into said second passageway, the attachment of said lower end of portion of said extension portion to said housing being such that fluid injected into said second passageway flows through said housing without flowing into said annular space.

2. The connector device of claim 1 wherein said valve includes a septum having an annular skirt attached to said first portion, said skirt extending over and attached to an outside surface of said housing proximate said opening.

3. The connector device of claim 2 wherein said septum includes an annular channel formed by said skirt and said first portion, a distal edge portion of said housing received in said channel.

4. The connector device of claim 3 wherein said distal edge portion forms a distal landing received in said channel, at least a portion of said distal landing being attached to said septum.

5. The connector of claim 4 wherein the entire length of said landing is attached to said septum.

6. The connector device of claim 5 wherein said connector includes a bonding agent to attach said outside surface of said housing and said landing to said septum.

7. The connector device of claim 1 wherein said second portion of said resealable valve is formed with a generally rectangular cross section in the proximate direction.

8. The connector device of claim 1 wherein said valve includes a septum having an annular skirt attached to said first portion, said skirt extending over and attached to an outside surface of said housing proximate said opening.

9. A connector device for establishing a sealed connection with a male luer assembly configured to conform to ISO standards, said assembly including a male luer tip and having a generally annular flange disposed generally about said male luer tip and defining a generally cylindrical space between said flange and said tip, said connector device comprising:

- a housing forming an upper opening and a central first passageway sized to receive the male luer tip, said housing having an upper end portion configured to fit within the generally cylindrical space defined by the male luer assembly when the male luer tip is inserted downward into said opening, said first central passageway extending from said opening in a downward direction within said housing;
- a resealable valve resiliently restrained relative to said housing, said valve including,
- a first portion configured to seal said opening prior to insertion of said tip and having an upper surface radially extending across said opening, said upper surface being disposed and shaped to be easily wipeable,
- a second portion integral with said first portion and extending generally vertically downward within said passageway from a lower surface of said first portion, and
- a third extension portion attached to said lower surface of said first portion and extending downward, a lower end portion of said third portion attached to said housing to form a sealed second passageway within said extension portion, said second portion extending within said

second sealed passageway portion, said third extension portion and said housing defining a generally annular space between said extension portion and said housing; and

an opening formed in said valve such that when the luer tip is inserted downward into said opening in said housing and through said septum said first portion and said second portion elastically extend about the luer tip and form a seal about said luer tip and allow fluid to be injected from said tip into said second passageway, the attachment of said lower end of portion of said extension portion to said housing being such that fluid injected into said second passageway flows through said housing without flowing into said annular space.

15 10. The connector device of claim 9 wherein said septum includes an annular channel formed by said skirt and said first portion, a distal edge portion of said housing received in said channel.

11. The connector device of claim 10 wherein said distal edge portion forms a distal landing received in said channel, at least a portion of said distal landing being attached to said septum.

12. The connector of claim 11 wherein the entire length of said landing is attached to said septum.

13. The connector device of claim 12 wherein said connector includes a bonding agent to attach said outside surface of said housing and said landing to said septum.

14. The connector device of claim 13 wherein said second portion of said resealable valve is formed with a generally rectangular cross section in the proximate direction.

* * * * *